Suggested Goal: DOT Standard for DSRC

- ✓Do old functions in new way
  - i.e. Toll Collection
- ✓Do New function not possible before
  - i.e. road / vehicle communication

Thank You

TRANSIT DSRC INTEREST

5.9 GHz STAKEHOLDERS WORKSHOP FOR ITS APPLICATIONS

December 16-17, 1999

Prepared for Federal Transit Administration

Joseph LoVecchio

DOT Volpe Center

Types of Transit DSRC Applications

- Download bus stored data at garage
  - passenger counts
  - fare collection
  - bus operational data
- Traffic signal priority
- Access to toll roads, facilities, parking lots

New Jersey Transit

Current DSRC use:

- Access to toll roads, bridges, tunnels, express lanes
- Traffic management information

Would like to use DSRC for:

- Download bus stored data at terminal

Seattle - King County Transit

Current DSRC use:

- Signal priority

Would like to use DSRC for:

- Download bus stored data at terminal

Chicago Transit Authority

Current DSRC use:

- None

Would like to use DSRC for:

- Download bus stored data at terminal
- Access control to property
- Last minute route, schedule changes as bus departs lot

Houston - Metropolitan Transit Authority

Current DSRC use:

- Toll Collection
- HOV access control

Would like to use DSRC for:

- Download bus stored data at terminal

Sample of Transit Market

- **Signal Priority Systems**
  - **23 agencies operational or being implemented**
  - **33 agencies planning**
- **Automatic Passenger Counters Systems**
  - **30 agencies operational or being implemented**
  - **34 agencies planning**

Other Applications Under Consideration

- Bus monitoring/identification at Natural Gas bus fueling depots
- Rail grade crossing warning for bus/vehicles
- Vehicle to vehicle fleet management applications

Summary

- There is significant transit interest in DSRC
- Widespread application has been limited by current bandwidth limitations, interference, lack of equipment interoperability
- The transit community supports the development of standards for 5.9 GHz DSRC

5.9 GHz Stakeholders Workshop

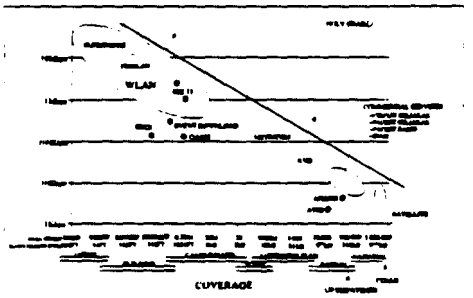
"Fleets" - Railroad

Howard G. Moody
Association of American Railroads

December 16, 1999

Background

- Railroads already have a one-way "AEI" tag for car (shipment) tracking using backscatter technology
- Have future data needs that may require larger file transmission and short range two-way communications
- Railroads have a several wireless communications networks, but are looking for "options" in the future



MOBILE WIRELESS DATA OPTIONS

General Application

- Would supplement AEI for large file transfer
- Would require transmission both to and from mobile vehicle (locomotive) at low speed
- Would be located in or near yards/terminals
- Would need railroad specific messages but use DSRC protocol

Typical Railroad Application

- Event recorder download where information on train /locomotive performance over last 24 hours is downloaded
  - Mbytes of information
  - done at low speed - 5 MPH
  - single vehicle
  - maximum range 200 feet
  - two tracks

DSRC Advantages for Railroads

- Can accommodate large file transactions
- low cost implementation on vehicles
- large market (highway) for products to reduce cost for small market (railroads)
- non-interfering, and don't have to compete/pay for spectrum

Status

- Looking at a host of alternatives for large file transfer to/from mobile, but no decisions have been made - more of a future system use
- Have an industry task force looking at potential wireless applications and technology
- ARINC provides substantial contractor support - so we are/will be aware of DCRC developments

A Vendor Perspective

Some Thoughts
for the
5.9 GHz Stakeholder Workshop
December 16-17, 1999

Dick Schnacke
Intermec / Amtech Systems Division

Intermec

Vendors - A huge stake

- Nobody cares more than DSRC vendors about:
  - how DSRC fares in the big ITS communications land grab
  - whether new ITS applications become real
  - how the 915 MHz vs 5.9 GHz shootout ends
- These things size our markets and scope our activities
- Vendors face crucial decisions today
  - and they have to bet the ranch on some of them (or at least the south forty)

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Vendor issues du jour

- Old 915 MHz vs new 915 MHz
- Either 915 MHz choice vs 5.9 GHz
- Single-mode vs multi-mode devices
- Support a few (core) services vs multi-appl.
- Stand-alone vs integrated onboard units
- IDB wireless link ?
- Technical: speed, range, data rate, etc.
- Customer migration
- A global market
- Liability (safety applications)
- Cost, cost, cost, cost

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Perceptions

	915 MHz	5.9 GHz
Technology	Old	New
Interference	Getting worse	No problems
Range	OK for toll, BUT	Allows new applications
National Interoperability	Doomed by legacy	Possible
Migration	Difficult	Easy
Cost	Not worth an upgrade	May be worth it
Destiny	**Will fade away**	**The FUTURE**

- **Are these perceptions justified?**

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Why move to 5.9 GHz?

- If the applications of the future are the same as the applications of today - there is no real reason to leave 915 MHz.
  - It works fine
  - No unworkable interference - and none expected that we can't deal with
    - Change channels, Increase power
  - Worst case - improve filtering & sensitivities (much cheaper than developing 5.9 GHz solutions)
  - It's inexpensive

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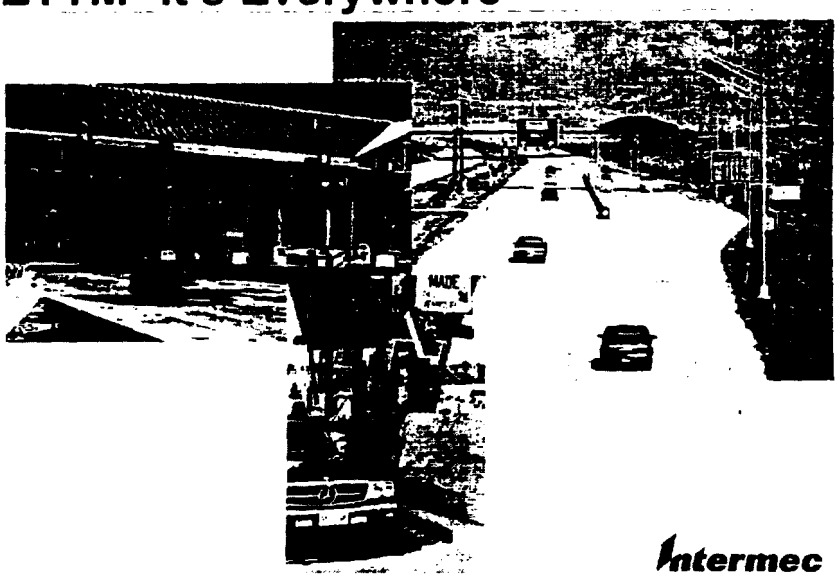
ETTM--It's Everywhere



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Many Markets Currently Served

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Why move to 5.9 GHz?

- There are only a few reasons to consider moving from 915 MHz to 5.9 GHz
  - Bandwidth for more applications
  - Protection for safety services
  - A 'fresh start' toward interoperability
- Everything else works to favor 915 MHz
  - The physics
  - Migration
  - Cost

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You Can't Beat the Physics

- Signal Attenuation
  - For same power, more attenuation = less range
  - Adequate range is especially important in high speed, long range applications
  - 915 MHz
    - Low atmospheric attenuation = Good range

    5.8 GHz
    - Higher atmospheric attenuation = Lower range

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You Can't Beat the Physics (cont.)

- Signal Fading
  - Fading effects are proportional to frequency
  - Directly affects the reliability of data transfer
  - Faded transmissions require re-send of data
  - 915 MHz
    - Moderate fading occurs
    - Re-send occasionally necessary
  - 5.8 GHz
    - Serious fading occurs: Re-send OFTEN necessary
    - Theory: 7 times worse than 915 MHz
    - Empirically: 3-4 times worse

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You Can't Beat the Physics (cont.)

- Microwave Line Losses
  - 915 MHz
    - Losses are low
    - RF source-to-antenna distances up to 200 feet
    - Allows all maintainable components to be conveniently located at ground level in safe, clear areas
  - 5.8 GHz
    - Losses are high
    - RF source-to-antenna distances must be very short
    - Requires RF components be located over the lane
    - Maintenance requires either very large, strong man-rated antenna structures or lane closure & man-lift

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You Can't Beat the Physics (cont.)

- Antenna Pattern
  - Small pattern = small communication zone
  - Small comm zone = short comm time
  - Advanced ITS applications require more time
  - 915 MHz
    - Inherently large (floodlight) pattern
  - 5.8 GHz
    - Inherently small (spotlight) pattern
    - Very short time to complete transaction
    - More hardware needed to cover the roadway

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Why move to 5.9 GHz?

- If we're serious about implementation of multiple new applications/services - especially safety services:

  It MUST be 5.9 GHz

  - Bandwidth
  - Protection (primary status)
  - Performance improvements
- So....if we're serious about moving beyond conventional services....the 915 vs 5.9 decision should be easy.

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The market wants more performance

- Support for multiple applications
- More range
- Ability to handle more data
  - memory
  - data rate
- More security
- More features

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Perceptions

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▼ Technology	Old	New
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▼ Range	OK for toll. BUT	Allows new applications
▼ National Interoperability	Doomed by legacy	Possible
▼ Migration	Difficult	Easy
▼ Cost	Not worth an upgrade	May be worth it
▼ **Destiny**	**Will fade away**	**The FUTURE**

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Reality

Higher frequency	=	More cost
Longer range	=	More cost
Higher data rate	=	More cost
Multi-appl. capability	=	More cost
More security	=	More cost
More features	=	More cost
TOTAL	=	Lots more cost

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How much is 'lots more' ?

- Best industry guesses today are:
- Basic 'low-end' tags: 2X - 3X
- Do-it-all 'high-end' tags: 5X

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Cost - a big concern

- 5.9 GHz product development costs (NRE) will be high
- DSRC has been a cost-driven industry (especially transponder prices)
- How much is too much cost?
- Will the market accept the cost?

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But.....it's 5.9 GHz !

Customers
don't
care !!

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What's required to make this work?

- VALUE to the customer has to increase proportional to cost
- MULTIPLE APPLICATIONS have to be there to justify additional cost
- User has to be given the opportunity to SELECT more capability for more cost

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Value

- A value benchmark has been established
- Added value might include:
  - more electronic payment opportunities
  - enroute traveler information
  - safety services
  - nationwide interoperability
- If new devices cost more, they should offer:
  - more capabilities
  - more features
  - more pizzazz

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Servicing REAL applications

- The chicken & egg dilemma:
  - Capable tags won't proliferate until a multi-service infrastructure appears
  - Hard to rationalize the infrastructure costs without a universe of capable tags
- The end-user will not break this cycle - it must be solved on the institutional side.
- Availability of services will pull capable tags into circulation.

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Letting the Customer Decide

- Who is the customer?
  - Traditionally - a service provider (toll authority, etc.) who installs infrastructure & resells tags. No choices are offered. Only one service is provided & the tag is simple.
  - The future - Tag customer should be the end user who knows what services he's interested in and buys an appropriate device from offered choices.
- How can the business model be changed?

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The Quiz

Answers

to the

Posed Questions

******Answers have been augmented with audience feedback***

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Question #1

- What applications, using short-range wireless communications, are expected to be commercially available:
  - Within one year - Same ones we have today
    - Toll. Border clearance. Parking. Taxi/Limo control at airports. Shell Oil: diagnostics from engine controllers. CVO mainline screening, priority control of traffic signals. traffic probes (TransCom). CVO/port/transit yard control. [other fleet management applications (dispatcher communications)]. fuel transactions

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Q1 Continued

- Within 1-3 years - Today + expanded payment systems + vehicle registration (VIN related; Electronic Lic. Plate)+ early transit data systems + (rudimentary) pilot safety systems
  - Vehicle-Vehicle communications
  - Dynamic data off vehicle databus
  - ATIS delivery (real time)
  - Cargo container ID for intermodal freight; baggage monitoring, waste management. vehicle emissions
  - Safety warning systems (e.g., Highway-Rail Intersections)

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